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Post-Cerro Grande Fire Environmental Sampling Data: Pueblo Canyon Alluvial Groundwater Samples Collected in June 2000

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Contents

List of Figures

List of Tables

Acronyms

DOE	US Department of Energy
EPA	US Environmental Protection Agency
ER	environmental restoration
MCL	maximum contaminant level
NMED	New Mexico Environment Department
WQCC	Water Quality Control Commission

1.0 INTRODUCTION

The Los Alamos National Laboratory's (the Laboratory's) Environmental Restoration (ER) Project collected alluvial groundwater samples in Pueblo Canyon on June 17 and June 19, 2000 (after the Cerro Grande fire). This report summarizes the analytical results of those sampling efforts.

Sampling was conducted before the summer monsoon season and before significant postfire flooding occurred in Pueblo Canyon. This sampling provided baseline data for later comparison with data from samples collected during the monsoon season because the chemistry of the floodwater could affect groundwater quality in the canyon. For more information, see the conceptual model at http://erproject.lanl.gov/Fire/Data/datahome.html#CE_Model. These groundwater sample locations were selected to represent potential spatial variability in water quality in Pueblo Canyon, and were chosen from existing alluvial groundwater monitoring wells.

2.0 SAMPLING AND ANALYSIS

Sampling

A total of six alluvial groundwater samples were collected at three alluvial wells located in Pueblo Canyon (Figure 2.0-1). Table 2.0-1 describes well locations, as well as the sampling date and number of samples collected for each well.

Table 2.0-1
Description of Pueblo Canyon Alluvial Wells Sampled in June 2000

Well	Description of Location	Date Sampled	Number of Samples Collected
PAO-1(a)	Upper Pueblo Canyon; approximately 1000 ft west of the confluence with Acid Canyon	6/17/00	1 filtered, 1 nonfiltered
PAO-4	Lower Pueblo Canyon; approximately 3100 ft southeast of the Los Alamos County Bayo Sewage Treatment Plant	6/19/00	1 filtered, 1 nonfiltered
PAO-5N	Lower Pueblo Canyon; approximately 1700 ft northwest of the White Rock "Y" (State Highway 4)	6/19/00	1 filtered, 1 nonfiltered

Both filtered and nonfiltered water samples were collected to characterize the difference in results caused by the presence of suspended solids. Filtered samples are used to evaluate the dissolved chemicals in samples. Nonfiltered samples are used to evaluate chemicals associated with the suspended sediment in addition to the dissolved chemicals. Filtered samples were prepared in the field by filtration through a 0.45-micron filter. All water samples were analyzed by analytical laboratories that are approved by the ER Project and that are external to the Laboratory.

The first major postfire storm event that caused flooding in Pueblo Canyon occurred on June 2, 2000. Therefore, ash-related chemicals and fire-fighting chemicals may be present in these samples due to the June 2 rain event. Because some chemicals or chemical concentrations not related to Laboratory operations have been identified in ash and flood-transported ash (muck), sampling results should be evaluated in that context. Data summaries for baseline ash and muck samples collected by the ER Project in June 2000 are provided at http://erproject.lanl.gov/Fire/Data/ash-muck.html.

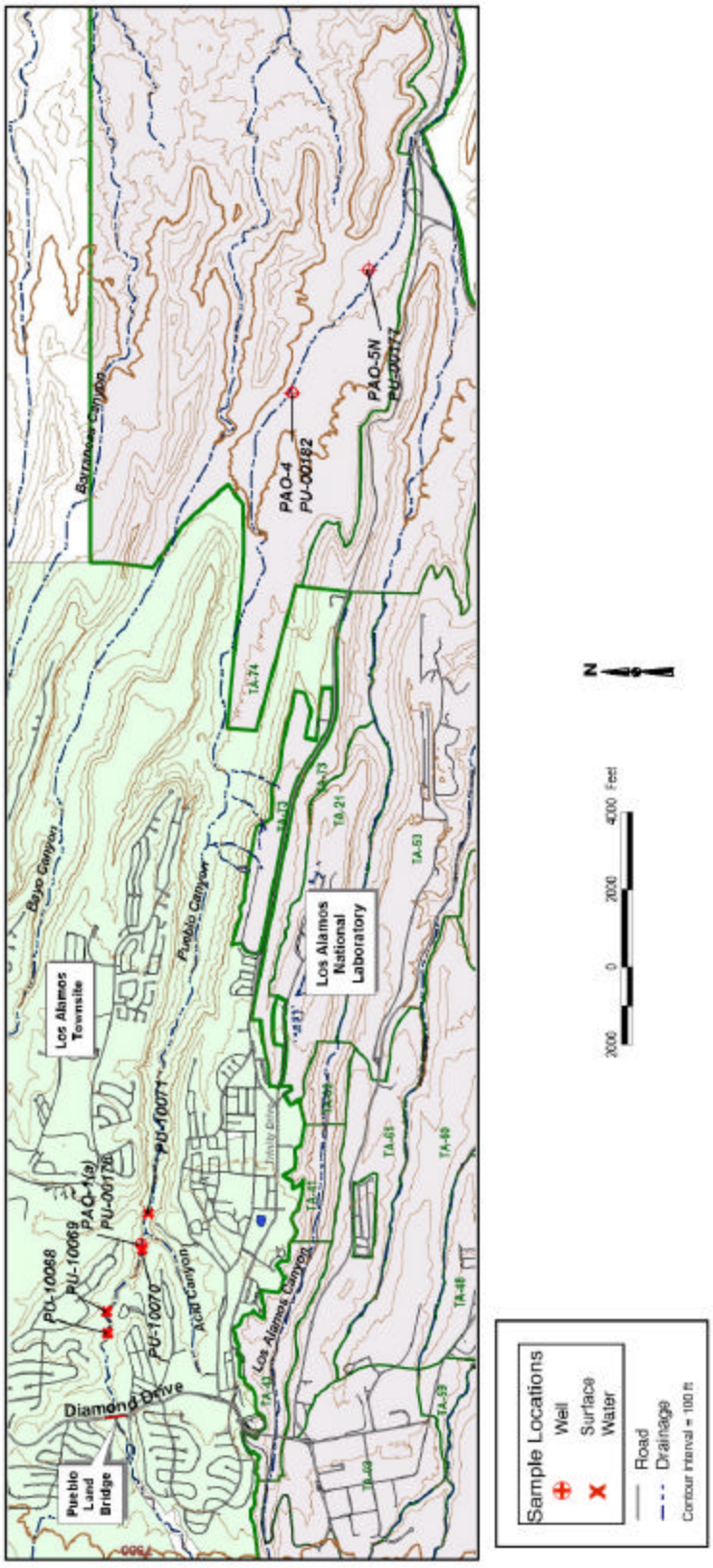

Figure 2.0-1. Post-Cerro Grande fire alluvial groundwater monitoring well and surface water sampling locations in Pueblo Canyon

Analysis

All filtered and nonfiltered samples were analyzed for the following inorganic chemicals and radionuclides: 24 trace metals, uranium, ammonia, nitrite and nitrate, total phosphorus, americium-241, isotopic plutonium (plutonium-238 and plutonium-239), isotopic uranium (uranium-234, uranium-235, and uranium-238), and strontium-90.

Only filtered samples were analyzed for the following chemicals: bicarbonate, carbonate, chloride, fluoride, sulfate, and total dissolved solids.

Only nonfiltered samples were analyzed for the following chemicals: organochlorine pesticides, polychlorinated biphenyl compounds, semivolatile organic compounds, total cyanide, gamma-emitting radionuclides, and tritium.

One nonfiltered sample collected from PAO-1(a) was analyzed for perchlorate, total Kjeldahl nitrogen, dioxins, and furans.

3.0 DATA SUMMARY TABLES

The inorganic and radionuclide chemical data for the water samples are summarized in two separate tables (Tables 3.0-1 and 3.0-2, respectively). Each table lists the chemical analyte, the number of samples analyzed, the number of detected results, and the minimum, mean, and maximum values for the detected results. No organic compounds were detected in any of the samples; therefore, no summary table is provided for organic compounds.

The summary tables compare the analytical results with US Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) drinking water maximum contaminant levels (MCLs). Current EPA drinking water MCLs, along with the supporting information, are available at http://www.epa.gov/safewater/mcl.html. The NMED MCLs are available under "Environmental Protection Regulations, Regulations by Subject, Drinking Water–20NMAC7.1," at http://www.nmenv.state.nm.us/.

The drinking water MCLs are used only as screening levels for the purposes of reviewing the alluvial groundwater sampling results. An exceedance of its screening level by a chemical does not necessarily mean that immediate action is necessary; an exceedance means only that further evaluation should be undertaken. The evaluation may include additional sample collection leading to a risk assessment to accurately assess the potential risk from exposure.

For radionuclides that do not have a drinking water MCL, the sample results are compared with screening levels that are 4% of the derived concentration guide values provided in US Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and Environment." The screening levels represent a dose limit of 4 millirem per year from the ingestion of water, consistent with the New Mexico Environment Department drinking water regulations (20NMAC7.1). DOE Order 5400.5 is available at http//tis.eh.doe.gov/oepa/guidance/risk/54005.pdf.

The filtered and nonfiltered results for inorganic chemicals are also compared with NMED Water Quality Control Commission (WQCC) groundwater standards. These standards apply to only filtered samples, with the exception of the mercury standard, which applies to nonfiltered samples. The WQCC groundwater standards are available under "Environmental Protection Regulations, Regulations by Subject, Ground and Surface Water Protection, 20NMAC6.2," at http://www.nmenv.state.nm.us/.

Table 3.0-1
Pueblo Canyon Alluvial Groundwater Samples, June 2000: Data Summary for Inorganics

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (µg/L)	Mean of Detects (µg/L)	Maximum of Detects (µg/L)	Drinking Water MCL[b] (µg/L)	Frequency of Detects > MCL	NMED[a] Groundwater Standard[c] (µg/L)	Frequency of Detects >NMED Groundwater Standard
Aluminum	F[d]	3	1	72.3	72.3	72.3	50	1/3	5000	0/3
Aluminum	NF[e]	3	2	48.6	60.7	72.8	—[f]	—	—	—
Ammonia (expressed as N)	F	3	3	120	10040	19000	—	—	—	—
Ammonia (expressed as N)	NF	3	3	170	9557	19000	—	—	—	—
Antimony	F	3	0	—	—	—	6	0/3	—	—
Antimony	NF	3	0	—	—	—	—	—	—	—
Arsenic	F	3	3	1.2	4.8	7	50	0/3	100	0/3
Arsenic	NF	3	3	1.3	4.8	6.6	—	—	—	—
Barium	F	3	3	36.9	82.7	164	2000	0/3	1000	0/3
Barium	NF	3	3	39.3	88.3	173	—	—	—	—
Beryllium	F	3	2	0.019	0.03	0.043	4	0/3	—	—
Beryllium	NF	3	2	0.028	0.03	0.033	—	—	—	—
Bicarbonate	F	3	3	100000	163333	240000	—	—	—	—
Boron	F	3	2	379	379	379	—	—	750	0/3
Boron	NF	3	3	29.13	273	396	—	—	—	—
Cadmium	F	3	0	—	—	—	5	0/3	10	0/3
Cadmium	NF	3	0	—	—	—	—	—	—	—
Calcium	F	3	3	19200	22033	26800	—	—	—	—
Calcium	NF	3	3	18800	22100	27100	—	—	—	—
Carbonate	F	3	0	—	—	—	—	—	—	—

Table 3.0-1 (continued)

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (µg/L)	Mean of Detects (µg/L)	Maximum of Detects (µg/L)	Drinking Water MCL (µg/L)	Frequency of Detects > MCL	NMED Groundwater Standard (µg/L)	Frequency of Detects >NMED Groundwater Standard
Chloride	F	3	3	38000	41000	43000	250000	0/3	250000	0/3
Chromium	F	3	3	0.61	0.90	1.1	100	0/3	50	0/3
Chromium	NF	3	3	0.58	1.2	1.8	—	—	—	—
Cobalt	F	3	3	0.11	3.4	8.3	—	—	50	0/3
Cobalt	NF	3	3	0.12	3.1	7.3	—	—	—	—
Copper	F	3	3	1.2	2.1	3.2	1300	0/3	1000	0/3
Copper	NF	3	3	2.1	3.1	5.1	—	—	—	—
Cyanide (total)	NF	3	0	—	—	—	—	—	—	—
Fluoride	F	3	3	150	410	560	4000	0/3	1600	0/3
Iron	F	3	3	20.1	1186	3340	300	1/3	1000	1/3
Iron	NF	3	3	45.6	1191	3300	—	—	—	—
Lead	F	3	2	0.193	0.29	0.387	15	0/3	50	0/3
Lead	NF	3	3	0.038	0.286	0.426	—	—	—	—
Magnesium	F	3	3	4390	4547	4800	—	—	—	—
Magnesium	NF	3	3	4450	4530	4600	—	—	—	—
Manganese	F	3	3	118	1299	2660	50	3/3	200	2/3
Manganese	NF	3	3	110	1233	2530	—	—	—	—
Mercury	F	3	0	—	—	—	2	0/3	—	—
Mercury	NF	3	0	—	—	—	—	—	2	0/3
Nickel	F	3	3	1.1	5.2	10.7	100	0/3	200	0/3
Nickel	NF	3	3	1.5	5.3	10.7	—	—	—	—

Table 3.0-1 (continued)

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (µg/L)	Mean of Detects (µg/L)	Maximum of Detects (µg/L)	Drinking Water MCL (µg/L)	Frequency of Detects > MCL	NMED Groundwater Standard (µg/L)	Frequency of Detects >NMED Groundwater Standard
Nitrate + nitrite (expressed as N)	F	3	2	64	307	550	10000	0/3	—	—
Nitrate + nitrite (expressed as N)	NF	3	2	72	686	1300	—	—	—	—
Perchlorate	NF	1	0	—	—	—	—	—	—	—
Phosphorus (total)	F	3	3	150	3717	7400	—	—	—	—
Phosphorus (total)	NF	3	3	170	3657	7300	—	—	—	—
Potassium	F	3	3	5990	11197	15500	—	—	—	—
Potassium	NF	3	3	5950	11450	15800	—	—	—	—
Selenium	F	3	3	1.5	1.7	1.8	50	0/3	50	0/3
Selenium	NF	3	3	1.7	1.9	2	—	—	—	—
Silver	F	3	3	0.05	0.06	0.07	100	0/3	50	0/3
Silver	NF	3	3	0.06	0.10	0.12	—	—	—	—
Sodium	F	3	3	33400	58033	71700	—	—	—	—
Sodium	NF	3	3	33400	58933	73300	—	—	—	—
Sulfate	F	3	3	4600	22533	44000	250000	0/3	600000	0/3
Thallium	F	3	1	0.056	0.056	0.056	2	0/3	—	—
Thallium	NF	3	1	0.093	0.093	0.093	—	—	—	—
Total dissolved solids	F	3	3	250000	310000	340000	500000	0/3	1000000	0/3
Total Kjeldahl nitrogen	NF	1	1	300	300	300	—	—	—	—
Uranium	F	3	3	0.037	0.156	0.319	—	—	5000	0/3

Table 3.0-1 (continued)

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (µg/L)	Mean of Detects (µg/L)	Maximum of Detects (µg/L)	Drinking Water MCL (µg/L)	Frequency of Detects > MCL	NMED Groundwater Standard (µg/L)	Frequency of Detects >NMED Groundwater Standard
Uranium	NF	3	3	0.045	0.156	0.299	—	—	—	—
Vanadium	F	3	3	2.6	3.7	4.5	—	—	—	—
Vanadium	NF	3	3	2.6	4.0	5	—	—	—	—
Zinc	F	3	0	—	—	—	5000	0/3	10000	0/3
Zinc	NF	3	1	18.4	18.4	18.4	—	—	—	—

[a] NMED = New Mexico Environment Department.

[b] MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

[c] State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.

[d] F = Filtered.

[e] NF = Nonfiltered.

[f] Value is not available or not applicable.

Table 3.0-2
Pueblo Canyon Alluvial Groundwater Samples, June 2000: Data Summary for Radionuclides

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (pCi/L)	Mean of Detects (pCi/L)	Maximum of Detects (pCi/L)	Drinking Water MCL[b] (pCi/L)	Frequency of Detects >MCL	DCG[a] Screening Level (pCi/L)	Frequency of Detects > DCG Screening Level
Americium-241	F[c]	3	0	—[d]	—	—	15[e]	0/3	1.2	0/3
Americium-241	NF[f]	3	0	—	—	—	—	—	—	—
Cesium-134	NF	3	0	—	—	—	—	—	80	0/3
Cesium-137	NF	3	0	—	—	—	—	—	120	0/3
Cobalt-60	NF	3	0	—	—	—	—	—	200	0/3
Europium-152	NF	3	0	—	—	—	—	—	800	0/3
Plutonium-238	F	3	0	—	—	—	15[e]	0/3	1.6	0/3
Plutonium-238	NF	3	0	—	—	—	—	—	—	—
Plutonium-239	F	3	2	0.086	0.1785	0.271	15[e]	0/3	1.2	0/3
Plutonium-239	NF	3	2	0.134	0.189	0.244	—	—	—	—
Ruthenium-106	NF	3	0	—	—	—	—	—	240	0/3
Sodium-22	NF	3	0	—	—	—	—	—	400	0/3
Strontium-90	F	3	0	—	—	—	8	0/3	—	—
Strontium-90	NF	3	1	1.14	1.14	1.14	—	—	—	—
Tritium	NF	3	3	14	34	71	20000	0/3	—	—
Uranium-234	F	3	2	0.096	0.151	0.206	—	—	20	0/3
Uranium-234	NF	3	3	0.072	0.12	0.215	—	—	—	—
Uranium-235	F	3	0	—	—	—	—	—	24	0/3
Uranium-235	NF	3	1	0.064	0.064	0.064	—	—	—	—

Table 3.0-2 (continued)

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (pCi/L)	Mean of Detects (pCi/L)	Maximum of Detects (pCi/L)	Drinking Water MCL (pCi/L)	Frequency of Detects >MCL	DCG Screening Level (pCi/L)	Frequency of Detects > DCG Screening Level
Uranium-238	F	3	1	0.092	0.092	0.092	—	—	24	0/3
Uranium-238	NF	3	1	0.14	0.14	0.14	—	—	—	—

[a] DCG = Derived concentration guide. DCG screening levels are based on the ingested water DCGs published in DOE Order 5400.5, *Radiation Protection of the Public and Environment* (January 1993). The DCG screening levels presented in this table are calculated as 4% of the ingested water DCGs and represent a dose limit of 4 millirem per year from the ingestion of water.

[b] MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

[c] F = Filtered.

[d] Value is not available or not applicable.

[e] Based on an MCL of 15 pCi/L for gross alpha particle activity (including radium-226 but excluding radon and uranium).

[f] NF = Nonfiltered.

4.0 REFERENCES

DOE (US Department of Energy) Order 5400.5, "Radiation Protection of the Public and Environment," January 1993, http//tis.eh.doe.gov/oepa/guidance/risk/54005.pdf.

Environmental Restoration Project, http://erproject.lanl.gov/Fire/Data/ash-muck.html.

EPA (US Environmental Protection Agency), National Primary Drinking Water Standards, http://www.epa.gov/safewater/mcl.html.

NMED (New Mexico Environment Department), Environmental Protection Regulations, Regulations by Subject, Drinking Water–20NMAC7.1, http://www.nmenv.state.nm.us/.

NMED (New Mexico Environment Department), Environmental Protection Regulations, Regulations by Subject, Ground and Surface Water Protection– 20NMAC6.2, http://www.nmenv.state.nm.us/.